PATENT COOPERATION TREATY

PCT

NOTIFICATION OF ELECTION

(PCT Rule 61.2)

From the INTERNATIONAL BUREAU

To:

Assistant Commissioner for Patents
United States Patent and Trademark
Office
Box PCT
Washington, D.C.20231
ETATS-UNIS D'AMERIQUE

in its capacity as elected Office

Date of mailing (day/month/year) 23 October 2000 (23.10.00)	
International application No. PCT/GB00/00454	**Applicant's or agent's file reference** P.Q. 12,805
International filing date (day/month/year) 11 February 2000 (11.02.00)	**Priority date** (day/month/year) 11 February 1999 (11.02.99)

Applicant

YIN, Jia, Hong et al

1. The designated Office is hereby notified of its election made:

   [X] in the demand filed with the International Preliminary Examining Authority on:

   07 September 2000 (07.09.00)

   [ ] in a notice effecting later election filed with the International Bureau on:

2. The election [X] was

   [ ] was not

   made before the expiration of 19 months from the priority date or, where Rule 32 applies, within the time limit under Rule 32.2(b).

The International Bureau of WIPO 34, chemin des Colombettes 1211 Geneva 20, Switzerland	**Authorized officer** Zakaria EL KHODARY
Facsimile No.: (41-22) 740.14.35	Telephone No.: (41-22) 338.83.38

PCT

NOTIFICATION OF THE RECORDING OF A CHANGE

(PCT Rule 92bis.1 and
Administrative Instructions, Section 422)

From the INTERNATIONAL BUREAU

To:

WALKER, Neville, Daniel, Alan
QED I.P. Services Limited
Dawley Road
Hayes
Middlesex UB3 1HH
ROYAUME-UNI

Date of mailing (day/month/year) 05 February 2001 (05.02.01)	
Applicant's or agent's file reference P.Q. 12,805	**IMPORTANT NOTIFICATION**
International application No. PCT/GB00/00454	**International filing date** (day/month/year) 11 February 2000 (11.02.00)

---

1. The following indications appeared on record concerning:

   [X] the applicant   [X] the inventor   [ ] the agent   [ ] the common representative

Name and Address KILBRIDE-NEWMAN, Robert 108 Newland Whitney OX8 6JQ United Kingdom	State of Nationality GB	State of Residence GB
	Telephone No.	
	Facsimile No.	
	Teleprinter No.	

---

2. The International Bureau hereby notifies the applicant that the following change has been recorded concerning:

   [X] the person   [ ] the name   [ ] the address   [ ] the nationality   [ ] the residence

Name and Address	State of Nationality	State of Residence
	Telephone No.	
	Facsimile No.	
	Teleprinter No.	

---

3. Further observations, if necessary:
   The above-identified applicant should now be deleted from record.

---

4. A copy of this notification has been sent to:

   [X] the receiving Office   [ ] the designated Offices concerned

   [ ] the International Searching Authority   [X] the elected Offices concerned

   [X] the International Preliminary Examining Authority   [ ] other:

The International Bureau of WIPO 34, chemin des Colombettes 1211 Geneva 20, Switzerland	Authorized officer Eugénia Santos
Facsimile No.: (41-22) 740.14.35	Telephone No.: (41-22) 338.83.38

Form PCT/IB/306 (March 1994)

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(51) International Patent Classification 7 : H04N 7/26	**A1**	(11) International Publication Number: **WO 00/48401**
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(30) Priority Data:
9903126.2   11 February 1999 (11.02.99)   GB

(71) Applicant *(for all designated States except US)*: CENTRAL RESEARCH LABORATORIES LIMITED [GB/GB]; Dawley Road, Hayes, Middlesex UB3 1HH (GB).

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(75) Inventors/Applicants *(for US only)*: YIN, Jia, Hong [GB/GB]; 3 Watermeadow Lane, Fulham, London SW6 2RW (GB). KILBRIDE–NEWMAN, Robert [GB/GB]; 108 Newland, Whitney OX8 6JQ (GB).

(74) Agent: WALKER, Neville, Daniel, Alan; QED I.P. Services Limited, Dawley Road, Hayes, Middlesex UB3 1HH (GB).

(81) Designated States: AE, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CR, CU, CZ, DE, DK, DM, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, TZ, UA, UG, US, UZ, VN, YU, ZA, ZW, ARIPO patent (GH, GM, KE, LS, MW, SD, SL, SZ, TZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG).

Published
With international search report.

(54) Title: APPARATUS AND METHOD FOR VIDEOSIGNAL WATERMARKING
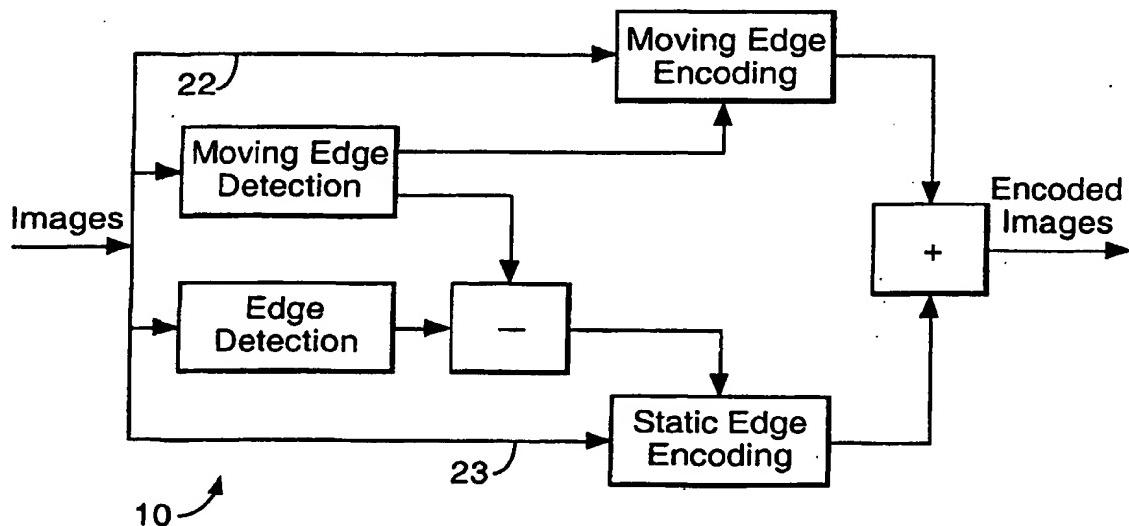
(57) Abstract

An apparatus for, and method of, encoding information into and decoding information from, a sequence of moving images, such as video images. It is known to insert codes into images for purposes of identifying the owner of the images. However, existing schemes have suffered from the disadvantage that certain data compression techniques have removed or degraded the code so that the code cannot be later recognised. The present invention solves the problem by identifying moving and static portions of an image in an image sequence and providing two separate channels, one for the moving portion of an image and the other for a static portion of an image. One or more codes are then inserted into both moving and static image channels, so that moving image sequences including the code are preserved even after image compression or low pass filtering.

APPARATUS FOR, AND METHOD OF, ENCODING INFORMATION INTO, AND DECODING INFORMATION FROM, A SEQUENCE OF MOVING IMAGES

5

The present invention relates to an apparatus for, and method of, encoding information into and decoding information from a sequence of moving images. The technique of coding information into a sequence of video or cinematographic images is also known as electronic watermarking. The invention is therefore particularly, but not exclusively,

10 suitable for electronic watermarking all types of media having moving images stored thereon or involving the transmission or broadcast of moving image data.

In video broadcasting, data can be in either digital or analogue form. Increasingly data is transmitted in digital form. One reason for this is because larger amounts of data can be

15 transmitted in digital form than in analogue form. Another is because digital signals are less prone to interference and can easily be recovered by using error correction techniques if received images are distorted. However, as side effects of facile access to digital data, complaints of copyright infringement and for tampering or modification of content are increasing.

20

It is known to insert codes into images for the purpose of identifying the owner of the images. The images may be in the form of video transmissions, or video clips or stills, for example for transmission across a telecommunication link. There are a number of known schemes for inserting identification codes into so called 'sync' periods in transmitted

25 video images. More recently it has been proposed to insert identification codes into the image itself in such a way that the code cannot be detected by a human eye. However, such schemes may suffer from the disadvantage that low pass filtering and other image processes, such as data compression, may remove the code or degrade it to an extent that it cannot be recognised.

30

UK Patent Application GB-A-2 305 803 (Philips) describes a method of correcting errors which occur in a telecine scanning process. The method involves sampling an area of an image which includes a structure and comparing this sampled structure with subsequently

sampled structures obtained from subsequent image frames. Use of motion vectors obtained is then made to correct picture steadiness.

5   All current schemes suffer from the disadvantage that coded digital information cannot easily be transformed and maintain its integrity. Low pass filtering and other processes, such as data compression, may occur as a result of image compression algorithms or transmission of audio signals across a telecommunication link. Such transforms may remove the code or degrade it to an extent where it cannot be recognised.

10   In the Applicant's published International Patent Application WO-A1-9625005 (Todd), there is described a method of coding data into an image. The method of coding and decoding information into an image, comprises: dividing the image into MxN blocks, selectively encoding (decoding) information into selected blocks in such a way as not to be visible to a human eye, wherein in a decoding stage, the decoding is synchronised to

15   the occurrence of the blocks for analysis of image information. In a preferred embodiment the size of insertions and their positions are fixed by processing the image in a block-by-block manner, typically with a block size of 8 by 8 pixels.

In MPEG compression standards, temporal redundancy in image sequences is reduced by

20   block-based motion compensation. Any change in an image from its previous frame caused by object movement is reserved to recover the image in the process of image decompression. Whilst previous encoding techniques have been successful, sometimes embedded codes have not survived MPEG compression.

25   The present invention arose to overcome this and associated problems.

According to the present invention there is provided a method of encoding information into a sequence of images; the sequence of images comprising a first image and a subsequent image; the method comprising the steps of: locating an edge in the first image,

30   locating a corresponding edge in a subsequent image, comparing relative positions of the corresponding edges in said images, thereby identifying at least one relatively moving edge; inserting a first code into said moving edge and inserting a second code into said static edge.

A corresponding apparatus is also provided.

The invention thus solves the problem of preserving both static and moving encoded

5   information during subsequent image compression. Another advantage of the present invention over the arrangement described in UK Patent Application GB-A-2305 803 (Philips) is the fact that the present invention is capable of diagrammatically encoding watermark code into a signal to be stored, or broadcast.

10   Preferably the apparatus and method identify moving, and therefore static edges, in an image sequence and treat moving and static edges as separate channels each carrying its own code(s). Hence identification information is encoded into both moving edges (which are not compressed to any extent) and static edges independently. Both channels may carry identical codes if required. Alternatively different codes may be inserted into

15   moving or static edges. The code insertion technique of the present invention may be used to embed codes in moving edge pixels.

Means is advantageously provided to preselect said relative moving edges so that a code can be inserted into switchable sequences. If there is not movement in a sequence of

20   images, no code is inserted and a different sequence may be selected.

Preferably coded information is inserted into an image in so called strongly featured regions of an image in such a way that the code is resistant to image compression and/or low pass filtering, but is not visible to the human eye. Examples of strongly featured

25   regions of images are textured regions or lines, or edges between two regions of different luminance or contrast. In such regions, it is possible to insert a relatively large amount of information without significantly altering the image.

Information encoded into an image may be used for a variety of purposes, for example:

30

    i)   to insert copyright or identification information into video clips or still images;

    ii)   to monitor when advertisements or films are played in broadcasts, for monitoring royalty payment purposes;

iii)   to identify a master copy of a data storage medium, such as a CD or DVD or video disc or similar medium, from which pirated copies may be produced.

Codes are preferably inserted in edges within an image. Edge regions are known to have masking properties because of the way the human visual system works. In particular, the local orientation of edges are important, and there are specific structures in the primary visual cortex of the human brain, for detecting the presence of an edge and its local orientation.

Coded information is preferably inserted into an image so that it does not alter the local orientation of certain features. The insertions are preferably made along the length of a local section of edge. The insertions are preferably made as a 2D function, by using for example an ellipse which is aligned to the local orientation of the edge.

According to another aspect of the present invention there is provided apparatus for decoding information from an encoded moving image sequence, comprising: means for identifying a region in an image in the sequence, means for determining whether the said region is a moving region or static region and means for recovering code from at least said moving image region.

Corresponding to this further aspect of the invention, there is also provided a method of decoding information from an encoded moving image sequence.
There is correspondingly also provided a method of encoding information into, and decoding information from, a moving image sequence, having one or more of the aforementioned preferred features.

Embodiments of the invention will now be described, by way of examples only, with reference to the Figures, in which:-

Figure 1 shows diagrammatically an embodiment of an encoder according to the invention;

Figure 2 shows an embodiment of a decoder according to the invention;

Figure 3 shows a sketch with edges of images in bold;

Figure 4 shows the sketch of Figure 3, with only moving edges highlighted in bold;

Figure 5 shows diagrammatically an embodiment of the invention, incorporated in a surveillance camera;

Figure 6 is a diagrammatical view of a supermarket in which the surveillance camera of Figure 5 may be used;

Figure 7 is an example of an image of pedestrian flow through a supermarket check-out area; and

Figure 8 is a vector diagram representative of the pedestrian flow of Figure 7.

Referring to the Figures, Figures 1 and 2 show block diagrams of an encoder 10 and decoder 20 respectively. The invention will now be described in the encoding sequence with reference to Figure 1. The signal is split into two portions: a moving image signal 22 and a static image signal 23. This can be according to a standard MPEG protocol or a different proprietary image analysis (compression) protocol.

A first code is inserted into the static image signal and a second code is inserted into the moving image signal. These signals are then transmitted via separate channels.

The moving edge encoding sequence is now described with reference to the following Equations 1 to 3 and Figures 3 and 4.

Moving edges and static edges may be defined as the following:

Let $I_1(x,y)$, $I_2(x,y)$ and $I_3(x,y)$ denote three consecutive images in an image sequence. Let $E_2(x,y)$ be an edge image from image $I_2(x,y)$. The moving edge image $ME(x,y)$ is defined as follows:

$$ME(x,y) = D_{12}(x,y).E_2(x,y).D_{23}(x,y) - (Eqn\ 1)$$

$$where\ D_{12}(x,y) = |I_1(x,y)-I_2(x,y)|,\ D_{23}(x,y) = |I_2(x,y) - I_3(x,y)|. - (Eqn\ 2)$$

5   The static edge image $SE(x,y)$ may be obtained using the following equation:

$$SE(x,y) =)\ E_2(x,y),\ if\ ME(x,y) = 0$$

Once inserted the coded information is treated the same as a moving image by any
10 compression algorithm or protocol such as MPEG. Static code is included in early
sequences of a series of encoded images so that when compressed the encoded
information remains in tact.

Brief reference will now be made to Figure 2, which depicts a decoder 20. Decoder 20
15 receives encoded images signal 24. The image signal 24 is split into a moving image
signal 26. Edge diffraction then occurs. Edge detector 27 detects edges in moving
images. Edge detector 28 detects edges in static images. Detected edge signals 29 and 30
are subtracted one from another at subtractor 31 and a static edge is decoded at static edge
decoder 32. Moving edges are decoded directly from a signal presented by moving edge
20 detector 27 to the moving edge decoder 33. Static edge decoded signals 34 and moving
edge decoded signals 35 are added at 36 to provide an electronic watermark signal which
indicates for example, the origin of a signal or the owner of copyright in an image
sequence or piece of video footage.

25 The invention may be used to encode information onto all forms of recording media.
These may include videotape, video disc, compact disc (CD or DVD), or any other form
of video storage medium. Similarly the invention may be incorporated into video
broadcasting systems, video editing equipment, video monitoring equipment, televisions,
computers or any other piece of electronic equipment used to produce or view video
30 images, including a video cassette recorder and/or a set-top box.

The invention has been described, by way of example only, and it will be understood that
variation may be made to the embodiments described without departing from the scope of

the invention. In an alternative embodiment, shown in Figures 5 to 8, the invention may be deployed within shops or other public places in order to monitor activity of purchasers or members of the public. The invention allows for the automation of data capture relating to motion of, say, shoppers and optionally, its subsequent encoding for transmission.

5

Figure 6 represents the layout of a typical supermarket. The system to be implemented uses real-time video data from appropriately positioned Close Circuit Television (CCTV) cameras to monitor the customers arriving at entrance 102, check-outs 106 and exit 104. The system uses information extracted from video data to estimate net arrival/departure rate of customers and from this maintains an estimate of the number of customers inside

10   the store at any time. This together with the information from the aforementioned areas enables the system to maintain estimates of the number of customers:

a)   within the store shelf area

15   b)   queuing at the check-outs

In addition a correlation between the number of customers arriving at the check-outs and the number of customers arriving at the store at some earlier time allows the system to adaptively optimise parameters of a prediction model of the store. This optimised

20   prediction model enables the system to estimate impending customer demand for check-outs in advance of the need becoming apparent. This allows for timely staff re-deployment to avoid any reduction in customer service.

Output from the system is preferably in two main forms:

25

1.   Real-time data concerning conditions in the store as they happen. This data in turn may be presented either

a)   On a screen in some management area, or

b)   As immediately useful instructions relayed through radio headsets. These

30   instructions need to be unambiguous. It is envisaged at this stage that the instructions consist of messages to open or close a number of check-outs.

2.   The system will be capable of producing a statistical report concerning the arrival rate of customers and the length of time they stay in the store. This data will be

suitable for planning overall staff levels and will be a useful source of marketing information.

Imaging equipment may be used in conjunction with a microprocessor dedicated to determining length of queues or regions of a store visited by an unusually large or small number of customers. This may be particularly advantageous in predicting employee allocation at check-outs for example. Similarly the system may be configured to monitor automatically a specific region of a store or even a specific aisle or display. By adapting control and analytical software the system may be arranged to provide a statistical assessment of how popular or unpopular a particular type of marketing or location of a product is performing.

CLAIMS

1. Apparatus for encoding information into a moving image sequence, comprising: means for identifying a region in an image in the sequence, means for determining whether the said region is a moving or static region and means for inserting a coded into at least said moving image region.

2. Apparatus for decoding information from an encoded moving image sequence, comprising: means for identifying a region in an image in the sequence, means for determining whether the said region is a moving or static region and means for recovering code from at least said moving image region.

3. Apparatus according to claim 1 or 2 wherein means is provided to identify moving and static edges and signals representative of said moving and static image regions are sent via first and second channels so that code is inserted into, or recovered from, either or both of said channels.

4. Apparatus according to claim 1, or claim 3 when dependant on claim 1, wherein a first code is inserted into signals in a first channel and a second code is inserted into signals in said second channel.

5. Apparatus according to claim 4 wherein the first and second codes are identical.

6. Apparatus according to claim 4 wherein the first and second codes are different.

7. Apparatus according to any claim 1 wherein code is inserted into a moving image region of a moving image sequence in such a way that the code is resistant to image compression.

8. Apparatus according to claim 1 wherein code is inserted into a region of a moving image so that the code is resistant to low pass filtering.

9. Apparatus according to claims 1, 7 or 8 wherein the code is inserted into boundaries between regions of different luminance, chrominance or contrast.

5 10. Apparatus substantially as herein described and with reference to the Figures.

11. Apparatus according to any of claims 1 to 9 which is included in video recording, video broadcasting, video viewing equipment; or a television receiving or a set-top box.

10

12. Apparatus according to any of claims 1 to 9, including a digital imager, arranged to obtain images of moving objects on a static background and to transmit signals indicative of the objects to a location remote from said imager.

15 13. Apparatus according to claim 12 operating under control of software for statistically analysing said code, so as to provide an indicator of the amount of movement of the objects during a chosen time interval.

14. A method of encoding information into, or decoding information from, a moving
20 image sequence using the apparatus of claims 1 to 9.

15. A method of encoding information into a sequence of images; the sequence of images comprising: a first image and a subsequent image, the method comprising the steps of: locating an edge in the first image, locating a corresponding edge in
25 the subsequent image, comparing relative positions of the corresponding edges in said first and second images, thereby identifying either a relatively static edge or two relatively moving images; inserting a first code into said moving edge and inserting a second code into said static edge.

30 16. A medium storing a video or cinematographic image or sequence of images thereon, characterised in that a code has been inserted into selective portions of said images, according to the method of claim 14, when dependant on claims 1 or claims 4 to 9, or claim 15.

11

ABSTRACT

An apparatus for, and method of, encoding information into and decoding information from, a sequence of moving images, such as video images.

5

It is known to insert codes into images for purposes of identifying the owner of the images. However, existing schemes have suffered from the disadvantage that certain data compression techniques have removed or degraded the code so that the code cannot be later recognised.

10

The present invention solves the problem by identifying moving and static portions of an image in an image sequence and providing two separate channels, one for the moving portion of an image and the other for a static portion of an image. One or more codes are then inserted into both moving and static image channels, so that moving image sequences including the code are, preserved even after image compression or low pass filtering.

15

(Figure 1 accompanies the abstract)

1/5

Fig.1.
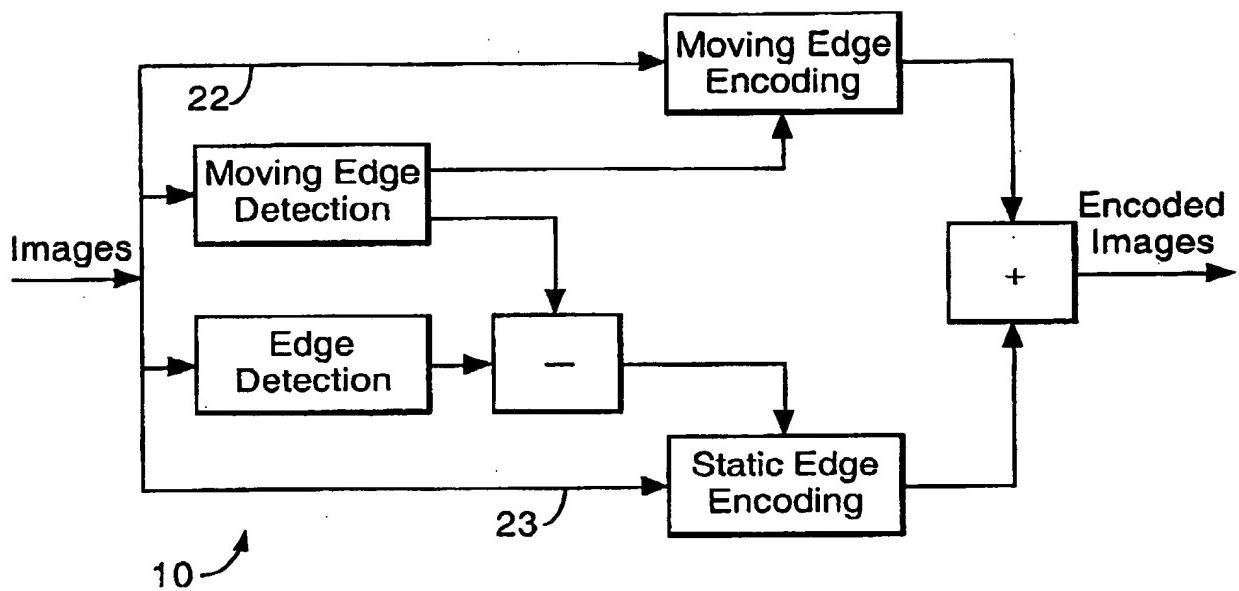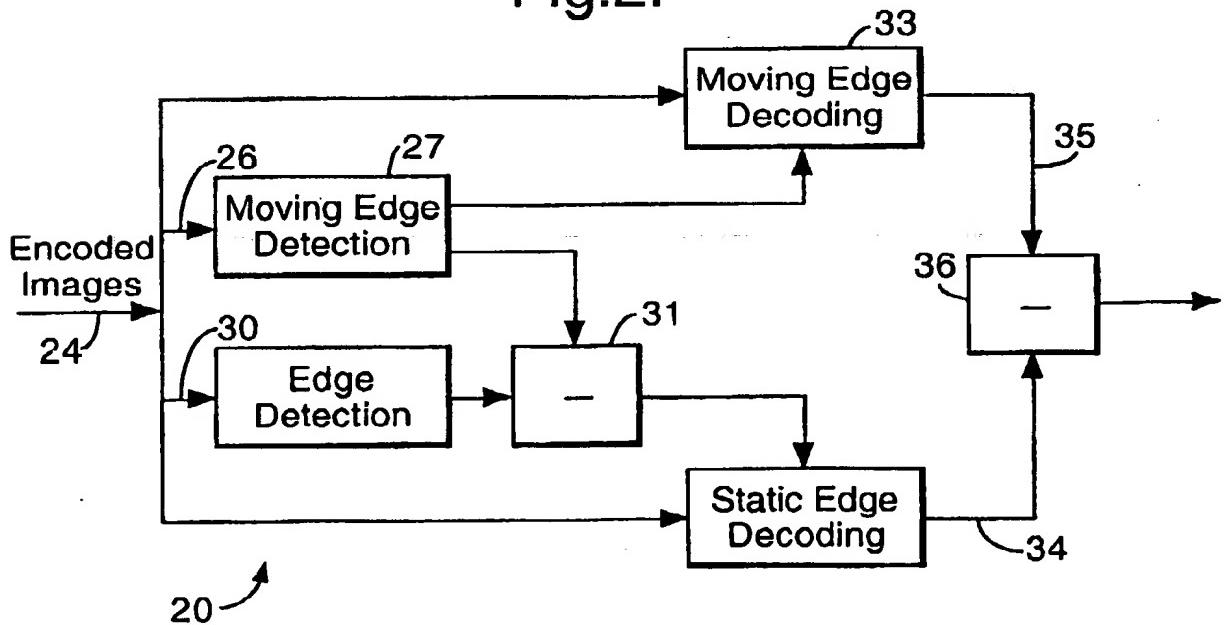
Images →

Moving Edge Detection
22

Edge Detection

Moving Edge Encoding

−

Static Edge Encoding
23

+ → Encoded Images

10

Fig.2.

Encoded Images →
24

Moving Edge Detection
26   27

Edge Detection
30

Moving Edge Decoding
33

−
31

Static Edge Decoding
34

−
35   36

→

20

09/890977

Fig.3.

Fig.4.

09/890977

Fig.5.

Fig.6.

ENTRANCE

102

100

106a

106b

106c

106d

EXIT

104
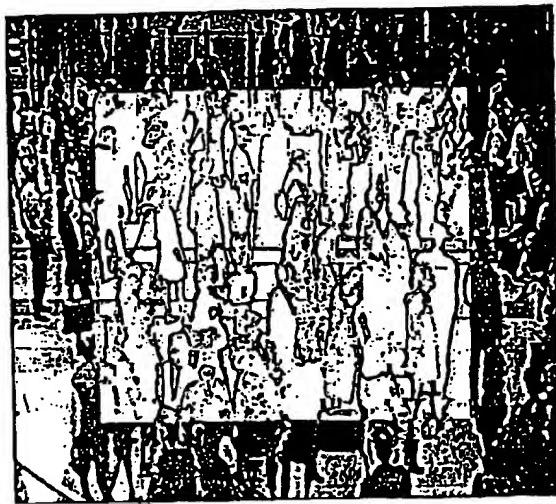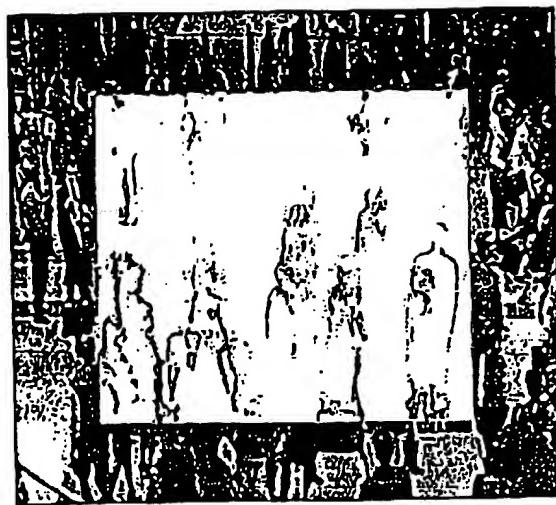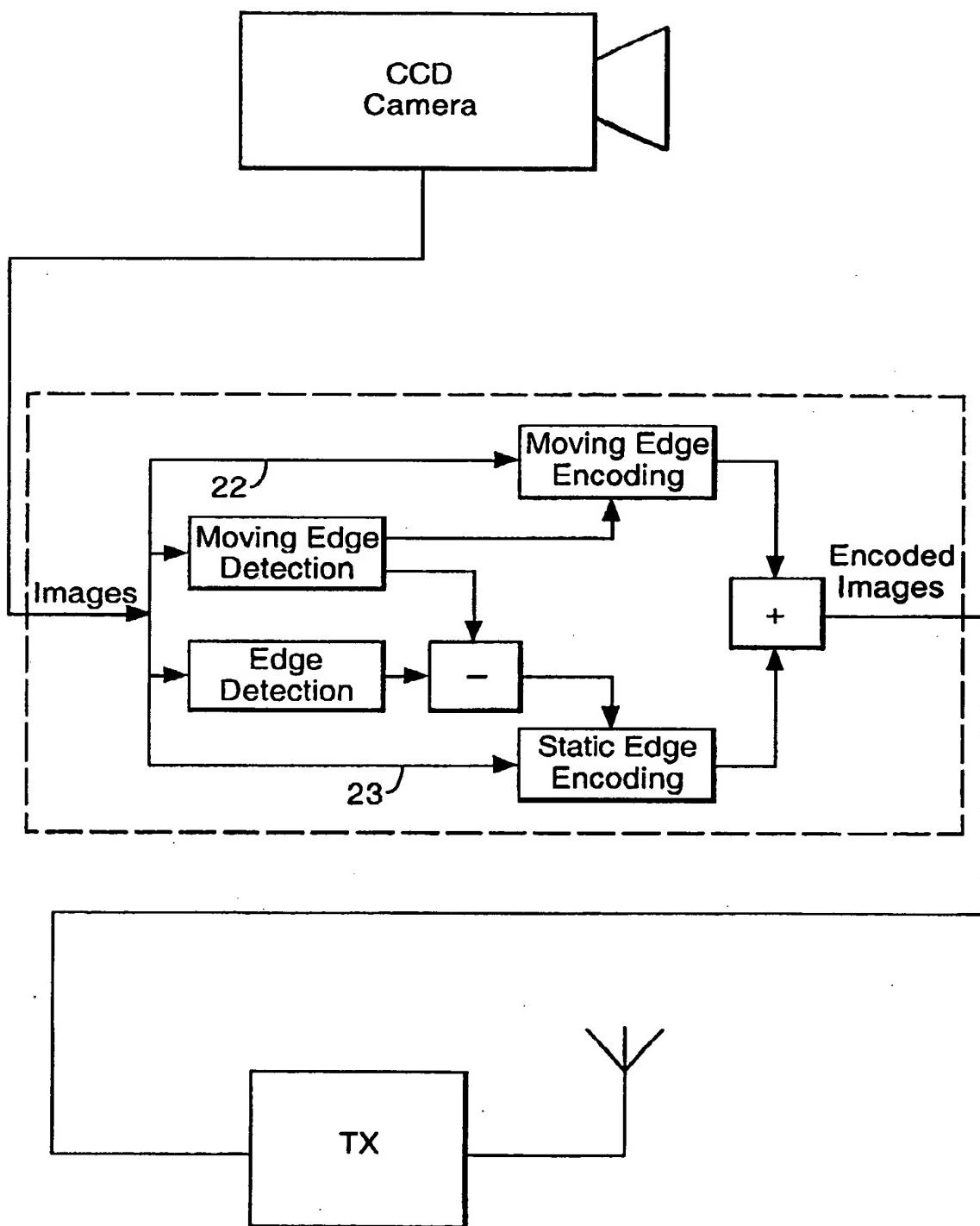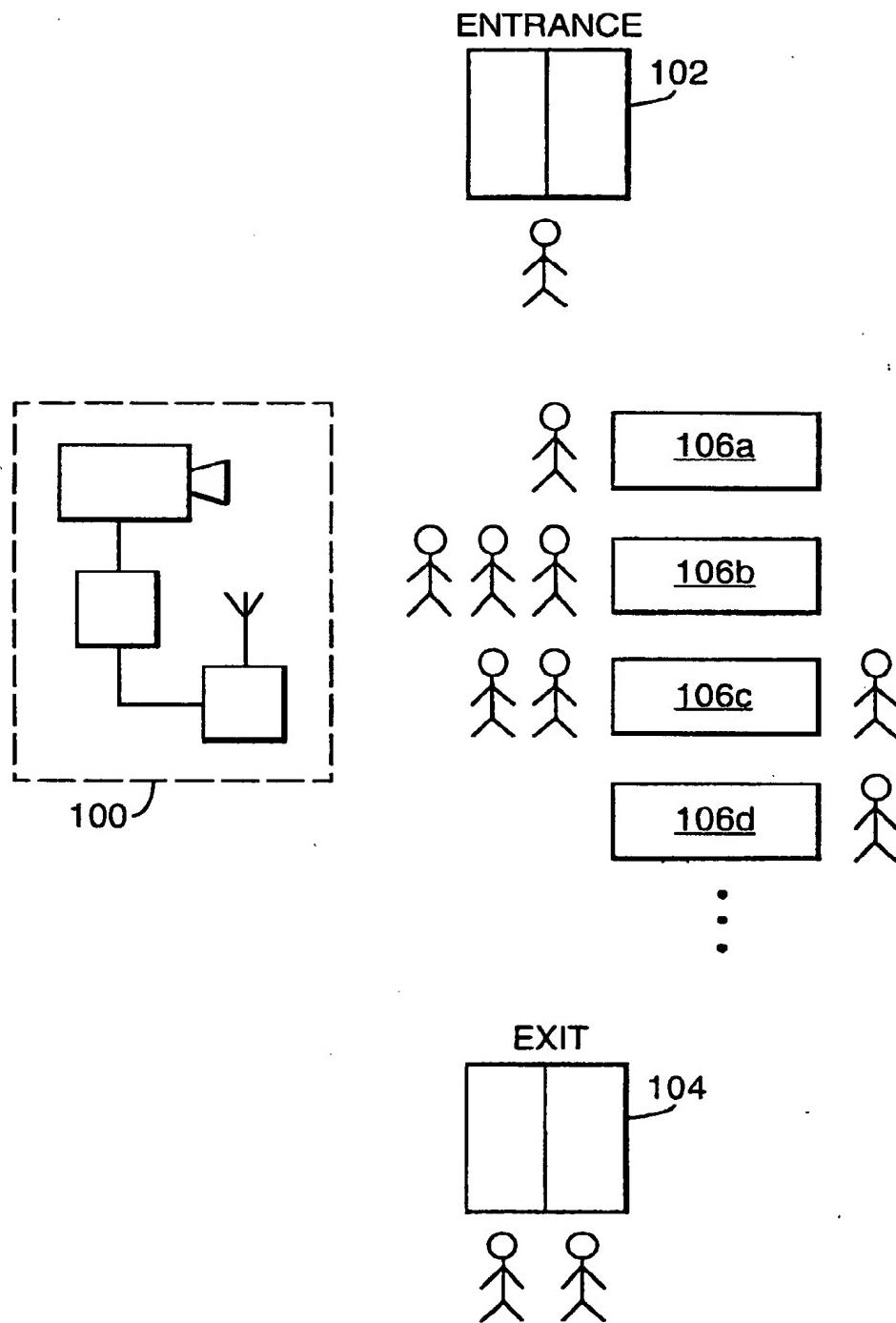
5/5

Fig.7.
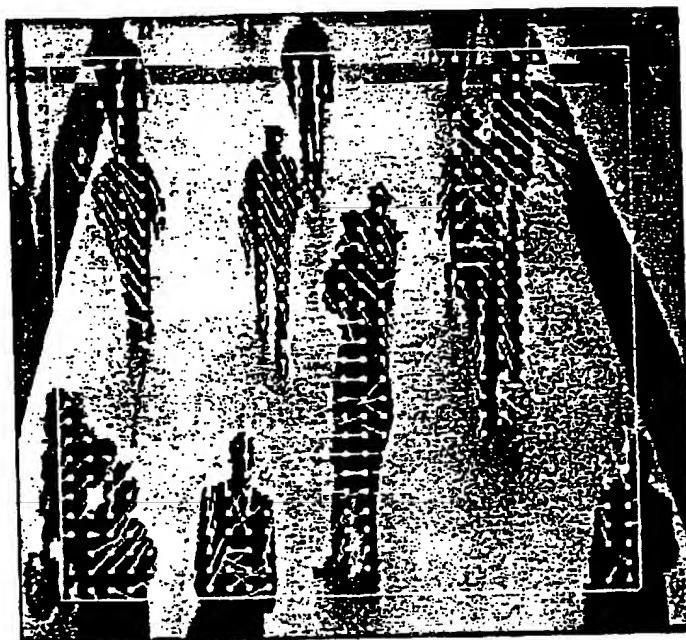
Fig.8.
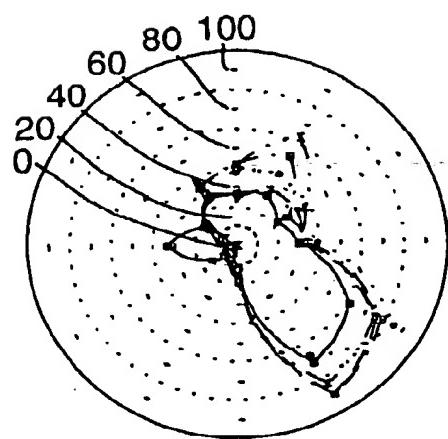
-t1 -t2 -t3 -t4 -t5

PATENT COOPERATION TREATY

PCT

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference P.Q. 12,805	**FOR FURTHER ACTION**	See Notification of Transmittal of International Preliminary Examination Report (Form PCT/IPEA/416)
International application No. PCT/GB00/00454	International filing date *(day/month/year)* 11/02/2000	Priority date *(day/month/year)* 11/02/1999

International Patent Classification (IPC) or national classification and IPC H04N7/26

Applicant CENTRAL RESEARCH LABORATORIES LIMITED et al.

1. This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.

2. This REPORT consists of a total of 7 sheets, including this cover sheet.

    ☐ This report is also accompanied by ANNEXES, i.e. sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).

    These annexes consist of a total of sheets.

3. This report contains indications relating to the following items:

    I   ☒ Basis of the report
    II   ☐ Priority
    III   ☒ Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
    IV   ☐ Lack of unity of invention
    V   ☒ Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
    VI   ☐ Certain documents cited
    VII   ☒ Certain defects in the international application
    VIII ☒ Certain observations on the international application

Date of submission of the demand 07/09/2000	Date of completion of this report 20.02.2001
Name and mailing address of the international preliminary examining authority: European Patent Office D-80298 Munich Tel. +49 89 2399 - 0 Tx: 523656 epmu d Fax: +49 89 2399 - 4465	Authorized officer Schindewolf, G Telephone No. +49 89 2399 8953

Form PCT/IPEA/409 (cover sheet) (January 1994)

I. Basis of the report

1. This report has been drawn on the basis of *(substitute sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to the report since they do not contain amendments (Rules 70.16 and 70.17).)*:

   Description, pages:

   1-8   as originally filed

   Claims, No.:

   1-16   as originally filed

   Drawings, sheets:

   1-5   as originally filed

2. With regard to the **language**, all the elements marked above were available or furnished to this Authority in the language in which the international application was filed, unless otherwise indicated under this item.

   These elements were available or furnished to this Authority in the following language: , which is:

   ☐   the language of a translation furnished for the purposes of the international search (under Rule 23.1(b)).

   ☐   the language of publication of the international application (under Rule 48.3(b)).

   ☐   the language of a translation furnished for the purposes of international preliminary examination (under Rule 55.2 and/or 55.3).

3. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, the international preliminary examination was carried out on the basis of the sequence listing:

   ☐   contained in the international application in written form.

   ☐   filed together with the international application in computer readable form.

   ☐   furnished subsequently to this Authority in written form.

   ☐   furnished subsequently to this Authority in computer readable form.

   ☐   The statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.

   ☐   The statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished.

4. The amendments have resulted in the cancellation of:

   ☐   the description,   pages:

   ☐   the claims,   Nos.:

☐ the drawings,   sheets:

5. ☐ This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed (Rule 70.2(c)):

(Any replacement sheet containing such amendments must be referred to under item 1 and annexed to this report.)

6. Additional observations, if necessary:

III. Non-establishment of opinion with regard to novelty, inventive step and industrial applicability

1. The questions whether the claimed invention appears to be novel, to involve an inventive step (to be non-obvious), or to be industrially applicable have not been examined in respect of:

☐ the entire international application.

☒ claims Nos. 10.

because:

☐ the said international application, or the said claims Nos. relate to the following subject matter which does not require an international preliminary examination (*specify*):

☒ the description, claims or drawings (*indicate particular elements below*) or said claims Nos. 10 are so unclear that no meaningful opinion could be formed (*specify*):
see separate sheet

☐ the claims, or said claims Nos. are so inadequately supported by the description that no meaningful opinion could be formed.

☐ no international search report has been established for the said claims Nos. .

2. A meaningful international preliminary examination report cannot be carried out due to the failure of the nucleotide and/or amino acid sequence listing to comply with the standard provided for in Annex C of the Administrative Instructions:

☐ the written form has not been furnished or does not comply with the standard.

☐ the computer readable form has not been furnished or does not comply with the standard.

V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)   Yes: Claims   2, 3, 9, 11-13, 15, 16

	No:	Claims	1, 4-8, 14
Inventive step (IS)	Yes:	Claims	
	No:	Claims	2, 3, 9, 11-13, 15, 16
Industrial applicability (IA)	Yes:	Claims	1-16
	No:	Claims	

2. Citations and explanations
   see separate sheet

VII. Certain defects in the international application

The following defects in the form or contents of the international application have been noted:
see separate sheet

VIII. Certain observations on the international application

The following observations on the clarity of the claims, description, and drawings or on the question whether the claims are fully supported by the description, are made:
see separate sheet

Re Item III
Non-establishment of opinion with regard to novelty, inventive step and industrial applicability

Claim 10 is unclear (Article 6 PCT), since it contains references to the description and the figures (Rule 6.2 (a) PCT).

Re Item V
Reasoned statement under Rule 66.2(a)(ii) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Reference is made to the following documents:

    D1: M D SWANSON ET AL: 'Object-based transparent video watermarking'
    IEEE WORKSHOP ON MULTIMEDIA SIGNAL PROCESSING.
    PROCEEDINGS OF SIGNAL PROCESSING SOCIETY WORKSHOP ON
    MULTIMEDIA SIGNAL PROCESSING,XX,XX, 23 June 1997 (1997-06-23),
    pages 369-374, XP002117815
    D2: TU ET AL.: 'Image Sequence Coding using Data Classification' SPIE -
    APPLICATIONS OF DIGITAL IMAGE PROCESSING XIII, vol. 1349, 10 July
    1990 (1990-07-10), pages 145-154, XP000910486 San Diego, CA, USA
    D3: WO 98 06216 A (TODD MARTIN PETER ;CENTRAL RESEARCH LAB LTD
    (GB)) 12 February 1998 (1998-02-12)

2. The present application does not meet the requirements of Article 33(1) PCT,
    because the subject-matter of claim 1 is not new in the sense of Article 33(2) PCT.

    Document D1 discloses (see page 371, line 11 - page 372, line 16 and figure 1)

    an apparatus for encoding information into a moving image sequence, comprising:

    means for identifying a region in an image in the sequence (see, in particular,
    page 371, lines 11-20),

means for determining whether the said region is a moving or static region (see, in particular, page 371, lines 34-45) and

means for inserting a code (sic!) into at least said moving image region (see, in particular, page 372, lines 1-16).

Therefore, document D1 anticipates the subject-matter of claim 1.

3. Document D2 (see the abstract and section 2. "SYSTEM DESCRIPTION") discloses means for determining whether an identified image region is moving or still and means for inserting a two bit indication code to inform the decoder which class the image region belongs to.

    Therefore, document D2 also anticipates the subject-matter of claim 1 in the present rather broad and general form.

4. The corresponding decoder is not explicitly disclosed in D1. It is however obvious if not even implicit that a corresponding decoder is necessary for recovering the inserted watermarks (see page 372, lines 17 ff for a description of watermark detection according to D1).

    The subject-matter of claim 2 therefore lacks an inventive step in the sense of Article 33 (3) PCT.

5. The features of claims 4-6 are disclosed in D1 (see page 372, lines 1-16).

6. The features of claims 7-8 are disclosed in D1 (see abstract).

7. Document D3 discloses (see, in particular, page 2, lines 1-12) edge detection and inserting of codes into the edge regions.

    Therefore, the subject-matter of claims 3, 9 and 15 appears to be rendered obvious by a combination of documents D1 and D3.

8. The subject-matter of claims 11, 12 and 16 relates to obvious applications of the known or obvious code inserting apparatus and methods defined in the previous claims.

9. The subject-matter of claim 13 is obvious in view of document D1 (page 371, lines 34-45).

10. The objections raised against apparatus claims also apply to corresponding method claims, for instance claim 14.

Re Item VII
Certain defects in the international application

(a) The features of the claims are not provided with reference signs placed in parentheses (Rule 6.2(b) PCT).

(b) Contrary to the requirements of Rule 5.1(a)(ii) PCT, the relevant background art disclosed in the document D1 is not mentioned in the description, nor is this document identified therein.

Re Item VIII
Certain observations on the international application

1. Claims 3 and 14 are not clear (Article 6 PCT), since it is not clear which features relate to encoding and decoding, respectively.

2. Claim 14 relates to a method but does not disclose any feature of the method itself. This results in a lack of clarity.

3. The minus sign in 36 of figure 2 of 21.3.2000 is in contradiction with figure 2 as originally filed and the description.

4. The term "coded" used in claim 1 contains a typing error.

PCT

INTERNATIONAL SEARCH REPORT

(PCT Article 18 and Rules 43 and 44)

Applicant's or agent's file reference P.Q. 12,805	**FOR FURTHER ACTION**	see Notification of Transmittal of International Search Report (Form PCT/ISA/220) as well as, where applicable, item 5 below.
International application No. PCT/GB 00/00454	International filing date *(day/month/year)* 11/02/2000	(Earliest) Priority Date *(day/month/year)* 11/02/1999

Applicant CENTRAL RESEARCH LABORATORIES LIMITED et al.

This International Search Report has been prepared by this International Searching Authority and is transmitted to the applicant according to Article 18. A copy is being transmitted to the International Bureau.

This International Search Report consists of a total of ____3____ sheets.

[X] It is also accompanied by a copy of each prior art document cited in this report.

1. **Basis of the report**

   a. With regard to the **language**, the international search was carried out on the basis of the international application in the language in which it was filed, unless otherwise indicated under this item.

   ☐ the international search was carried out on the basis of a translation of the international application furnished to this Authority (Rule 23.1(b)).

   b. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, the international search was carried out on the basis of the sequence listing :

   ☐ contained in the international application in written form.

   ☐ filed together with the international application in computer readable form.

   ☐ furnished subsequently to this Authority in written form.

   ☐ furnished subsequently to this Authority in computer readble form.

   ☐ the statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.

   ☐ the statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished

2. ☐ **Certain claims were found unsearchable** (See Box I).

3. ☐ **Unity of invention is lacking** (see Box II).

4. With regard to the **title,**

   ☐ the text is approved as submitted by the applicant.

   [X] the text has been established by this Authority to read as follows:

   APPARATUS AND METHOD FOR VIDEOSIGNAL WATERMARKING

5. With regard to the **abstract,**

   [X] the text is approved as submitted by the applicant.

   ☐ the text has been established, according to Rule 38.2(b), by this Authority as it appears in Box III. The applicant may, within one month from the date of mailing of this international search report, submit comments to this Authority.

6. The figure of the **drawings** to be published with the abstract is Figure No. ___1___

   [X] as suggested by the applicant.   ☐ None of the figures.

   ☐ because the applicant failed to suggest a figure.

   ☐ because this figure better characterizes the invention.

INTERNATIONAL SEARCH REPORT

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7   H04N7/26

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7   H04N

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	M D SWANSON ET AL: "Object-based transparent video watermarking" IEEE WORKSHOP ON MULTIMEDIA SIGNAL PROCESSING. PROCEEDINGS OF SIGNAL PROCESSING SOCIETY WORKSHOP ON MULTIMEDIA SIGNAL PROCESSING,XX,XX, 23 June 1997 (1997-06-23), pages 369-374, XP002117815	1,2,4-8, 10-12,14
Y	abstract	3,9,13, 15,16
	page 371, line 10 -page 372, line 16	
	——	
	-/--	

☒ Further documents are listed in the continuation of box C.   ☒ Patent family members are listed in annex.

° Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
17 May 2000	29/05/2000

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL – 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax: (+31-70) 340-3016	Foglia, P

Form PCT/ISA/210 (second sheet) (July 1992)

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication,where appropriate, of the relevant passages	Relevant to claim No.
Y	TU ET AL.: "Image Sequence Coding using Data Classification" SPIE — APPLICATIONS OF DIGITAL IMAGE PROCESSING XIII, vol. 1349, 10 July 1990 (1990-07-10), pages 145-154, XP000910486 San Diego, CA, USA abstract paragraph '0002! – paragraph '02.2!	3,13,15, 16
Y	WO 98 06216 A (TODD MARTIN PETER ;CENTRAL RESEARCH LAB LTD (GB)) 12 February 1998 (1998-02-12) the whole document	3,9,15, 16
A	MACQ B M ET AL: "CRYPTOLOGY FOR DIGITAL TV BROADCASTING" PROCEEDINGS OF THE IEEE,US,IEEE. NEW YORK, vol. 83, no. 6, 1 June 1995 (1995-06-01), pages 944-957, XP000518745 ISSN: 0018-9219 page 955, right-hand column, line 25 – line 38	3,9,15, 16
A	OHBUCHI R ET AL: "Data embedding algorithms for geometrical and non-geometrical targets in three-dimensional polygonal models" COMPUTER COMMUNICATIONS,NL,ELSEVIER SCIENCE PUBLISHERS BV, AMSTERDAM, vol. 21, no. 15, 1 October 1998 (1998-10-01), pages 1344-1354, XP004145248 ISSN: 0140-3664 paragraph '0003!	1-16
A	WO 98 17061 A (IBM JAPAN ;IBM (US)) 23 April 1998 (1998-04-23) abstract & EP 0 935 392 A (IBM) 11 August 1999 (1999-08-11) abstract paragraph '0005! – paragraph '0008!; claim 1	1

1

Patent document cited in search report		Publication date	Patent family member(s)		Publication date
WO 9806216	A	12-02-1998	GB	2330723 A,B	28-04-1999
WO 9817061	A	23-04-1998	CN	1233371 A	27-10-1999
			CZ	9901289 A	11-08-1999
			EP	0935392 A	11-08-1999
			PL	332701 A	27-09-1999
			US	6005643 A	21-12-1999